

**TITLE**

**PAPER DISCHARGING APPARATUS OF INK-JET PRINTER**

**CLAIM OF PRIORITY**

[0001] This application makes reference to, incorporates the same herein, and claims all benefits accruing under 35 U.S.C. §119 from an application for *PAPER DELIVERY DEVICE OF INK-JET PRINTER* earlier filed in the Korean Industrial Property Office on 7 August 2001, and there duly assigned Serial No. 47411/2001 by that Office.

**BACKGROUND OF THE INVENTION**

**Technical Field**

[0002] The present invention relates to a sheet discharging apparatus of a printer, and more particularly, to a sheet discharging apparatus that permits ink printed on the sheet to dry by delaying stacking the discharged printed sheet.

**Related Art**

[0003] In a general ink-jet printer, sheets of printed paper are discharged and then constantly stacked on a tray. As a printing speed of an ink-jet printer has increased, a speed of stacking discharged sheets of printed paper on a tray has increased. The increased speed of stacking causes the printed sheet to be stacked on the tray before ink on a previously printed sheet is dried. Therefore, ink printed on a sheet of lower-stacked paper is smeared over a back of upper-stacked paper.

1 [0004] In order to solve the above problem, there has been a known printer which delays  
2 stacking the discharged sheet. U.S. Patent No. 4,794,859 discloses an active paper drop for printers  
3 which has a pair of opposed, movable rail members associated with opposed walls of a horizontal-  
4 disposed output collection tray for receiving sheets of printed media. Each rail member has a return  
5 spring that act to maintain the rails in a closed position. In that position, the rails support a sheet of  
6 the print medium during the printing operation, thus giving the ink on the previously printed-on sheet  
7 time to dry. The rails are provided with a wing member and are pivotally secured in the floor of the  
8 output tray, with the pivot point spaced inwardly from the wing member. Downward pressure against  
9 the wing member thus causes the rail to rotate outward from its closed position, into a recess formed  
10 in the side of the output tray. This provides sufficient clearance for the sheet to drop into the output  
11 stack. Upon release of the downward pressure, the spring causes the rail member to return to its  
12 original closed position.

13 [0005] According to the conventional sheet discharging apparatus, however, since the holders  
14 pivot upwardly and downwardly without a variation in a distance between the holders, printing  
15 media such as a post card having a smaller width than a distance between the pair of holders cannot  
16 be supported. Therefore, when the printing media having the smaller width is sequentially printed,  
17 the conventional sheet discharging apparatus cannot solve the above problem.

18 [0006] In addition to that, the holders in the conventional sheet discharging apparatus are  
19 exposed from the vertical wall of the tray when the printer stands by for printing a sheet. Therefore,  
20 there is a problem of that the holders are damaged by an external shock.

**SUMMARY OF THE INVENTION**

[0007] It is therefore an object of the present invention to provide an improved printer.

[0008] It is another object to provide for an improved sheet discharging apparatus.

[0009] It is further an object to provide a sheet discharging apparatus capable of supporting printing media of various widths by adjusting a distance between holders.

[0010] It is a still further object to provide a sheet discharging apparatus in which the holders are not exposed to an external shock when the printer stands by for printing a sheet.

[0011] It is yet a further object to provide a sheet discharging apparatus that allows a size of the printer body to be reduced.

[0012] The discharging apparatus having features of the present invention may be constructed with a tray on which printed sheet is stacked, a holder supporting said printed sheet above said tray, and a moving means for moving said holder in a direction perpendicular to a sheet discharging direction.

[0013] The moving means includes a motor, a rack reciprocating in a direction perpendicular to a sheet discharging direction according to the driving of the motor, and a pinion connected to an end of a rotary shaft of the motor and engaged with the rack. The holder horizontally moves above the tray in association with a movement of the rack.

[0014] The holder and the rack are connected to each other through a lever which pivots in the sheet discharging direction in association with the movement of the rack. At an end of the lever is mounted a driven gear engaged with the rack, and at the other end of the lever is formed a

1 protrusion inserted into a guide slot which is formed in the holder.

2 [0015] It is preferable that a spring is interposed between the holder and the lever for biasing  
3 the lever to pivot toward the sheet discharging direction.

4 [0016] According to the sheet discharging apparatus as constructed above, the holder  
5 horizontally moves above the tray, thereby supporting printing media of various widths above the  
6 tray.

7 **BRIEF DESCRIPTION OF THE DRAWINGS**

8 [0017] The aforementioned object and characteristic of the present invention will be more  
9 apparent by describing a preferred embodiment of the present invention in greater detail with  
10 reference to accompanied drawings, in which:

11 [0018] FIG. 1 is a front section view showing a conventional sheet discharging apparatus;

12 [0019] FIG. 2 is a schematic perspective view showing an ink-jet printer employing a sheet  
13 discharging apparatus in accordance with the present invention;

14 [0020] FIG. 3 is a perspective view showing a driving mechanism of the sheet discharging  
15 apparatus of FIG. 2;

16 [0021] FIG. 4 is a plan view showing a rack starting to move in the sheet discharging  
17 apparatus of FIG. 2;

18 [0022] FIG. 5 is a plan view showing the rack being moved further than that of FIG. 4; and

19 [0023] FIG. 6 is a plan view showing the rack being moved further than that of FIG. 5.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

[0024] A preferred embodiment of the present invention will be described in greater detail with reference to the accompanied drawings.

[0025] As shown in FIG. 1, a conventional paper discharging apparatus has a tray 1 on which printed paper is stacked, and a pair of holders or supporting members 2 pivotally disposed on a bottom surface of the tray 1, for holding a sheet of printed paper "P".

[0026] The holders 2 pivot between an open position wherein each of the holders 2 fit into a recess 4 formed on a vertical wall 3 of the tray 1 and a close position wherein each of the holders 2 leans out of the vertical wall 3 at a predetermined angle. The holder 2 is provided with a return spring 5 for returning the holder 2 to the close position. In the close position, the holders 2 support the sheet of printed paper "P" above the tray 1 during a printing operation, thereby allowing ink printed on the sheet of printed paper "P" previously stacked on the tray 1 to dry.

[0027] As shown in FIG. 2, a sheet discharging apparatus includes a tray 10 on which sheets of printed paper are consecutively stacked, a first holder 20a and a second holder 20b which are opposed, spaced apart, and respectively mounted at both sides of the tray 10, for supporting sheets of printed paper, a rack 30 reciprocating in a direction perpendicular to a sheet discharging direction "A" to horizontally move the first and the second holders 20a and 20b above the tray 10, and a first lever 40a and a second lever 40b connecting the first and the second holders 20a and 20b to the rack 30, respectively.

[0028] When the first and the second holders 20a and 20b stand by for printing a sheet, they are within a case 100. As the first and the second levers 40a and 40b pivot, on hinge shafts 42a and

1 42b, toward a center of the sheet discharging direction "A", the first and the second holders 20a and  
2 20b are exposed out of the case 100. In this position, the first and the second holders 20a and 20b  
3 support the printed sheet and keep it elevated above the tray 10, thus giving the ink on the previously  
4 printed-on sheet time to dry.

5 [0029] As shown in FIG. 3, in an inside of the printer body is mounted a motor 50 as a  
6 driving source for driving the rack 30. At an end of a rotary shaft of the motor 50 is mounted a  
7 pinion 51 engaged with teeth of the rack 30. The pinion 51 receives a motion transferred from the  
8 motor 50 and transfers the motion to the rack 30. The pinion 51 rotates both in a normal and a  
reverse direction, *i.e.*, left and right, so that the rack 30 moves in a direction perpendicular to the  
sheet discharging direction "A".

[0030] The first and the second holders 20a and 20b have guide slots 21a and 21b  
respectively which are rounded toward a center of the tray 10.

[0031] The first and the second levers 40a and 40b are mounted pivotally on the hinge shafts  
42a and 42b. At ends of the respective first and second levers 40a and 40b are provided driven gears  
43a and 43b formed integrally with the first and the second levers 40a and 40b. On the other ends  
of the first and the second levers 40a and 40b are formed protrusions 41a and 41b which are inserted  
into the guide slots 21a and 21b of the first and the second holders 20a and 20b. The first lever 40a  
is indirectly connected to the rack 30 in a manner that the driven gear 43a is engaged with an idle  
gear 60 engaged with the rack 30. The second lever 40b is directly connected to the rack 30 in a  
manner that the driven gear 43b is engaged with the rack 30. Due to the presence of the idle gear  
60 interposed between the first lever 40a and the rack 30, the first and the second levers 40a and 40b

1 symmetrically pivot in association with the movement of the rack 30 at the same time.

2 [0032] Means for elastically biasing the first and the second levers 40a and 40b in favor of  
3 pivoting are provided. As shown in FIG.3, torsion springs 22a and 22b bias the first and the second  
4 levers 40a and 40b in the sheet discharging direction "A". The spring motion may be achieved by  
5 a variety of ways, such as with coil or leaf springs and the like.

6 [0033] The rack 30, a toothed bar, includes first gear teeth 31a and second gear teeth 31b.  
7 The first gear teeth 31a are engaged with the idle gear 60 connected to the first lever 40a. The second  
8 gear teeth 31b are engaged with the driven gear 43b connected to the second lever 40b. Where the  
9 first gear teeth 31a are indirectly connected to the first lever 40a through the idle gear 60 and the  
10 second gear teeth 31b are directly engaged with the second lever 40b, the second gear teeth 31b,  
11 compared with the first gear teeth 31a, protrude in the sheet discharging direction "A" as much as  
12 a space between the rack 30 and the end of the first lever 40a. This protrusion makes it possible for  
13 front ends of the first and second holders 20a and 20b to correspond to each other. It is also  
14 preferred that a length of the first gear teeth 31a is longer than that of the second teeth 31b.

15 [0034] With reference to FIGS. 4 through 6, an operation of the sheet discharging apparatus  
16 according to the present invention will be described.

17 [0035] When the printer stands by to print a sheet, the first and the second levers 40a and 40b  
18 are fit into in the case 100 as shown in FIG. 2. When the printer starts printing, the motor 50  
19 rotatably drives the pinion 51 in a normal direction (illustrated by solid arrows in FIGS. 4 and 5), so  
20 that the rack meshed into the pinion 51 starts to move in a right direction (illustrated by solid arrows  
21 in FIGS. 4 and 5). When the rack 30 moves in the right direction, the idle gear 60 meshed with the

1 rack is rotated in the normal direction. Due to the rotation of the idle gear 60, the first lever 40a  
2 pivots on the hinge shaft 42a in a counterclockwise direction. The second lever 40b pivots on the  
3 hinge shaft 42b in a clockwise direction due to the movement of the rack 30.

4 [0036] As shown in FIG. 4, each of the protrusions 41a and 41b moves along the respective  
5 guide slots 21a and 21b of the first and the second holders 20a and 20b, so that the first and second  
6 levers 40a and 40b pivot toward a center of the sheet discharging direction "A" as much as lengths  
7 of the guide slots 21a and 21b. At this point, the springs 22a and 22b elastically recover to allow the  
8 first and the second levers 40a and 40b to easily pivot.

9 [0037] If the rack 30 moves further in the right direction, the first and the second levers 40a  
10 and 40b pivot further toward the center of the sheet discharging direction "A" as shown in FIG. 5.  
11 Due to the pivotal movements of the first and the second levers 40a and 40b, the first and the second  
12 holders 20a and 20b escape from the case 100 (refer to FIG. 2) to be positioned above the tray 10.  
13 In this position, the first and the second holders 20a and 20b support a sheet of paper "P" and keep  
14 it elevated above the tray 10.

15 [0038] At the termination of printing and discharging of the sheet "P", the motor 50 drives  
16 the pinion 51 in a reverse direction (illustrated by dotted arrows in FIG. 5), so that the rack 30  
17 meshed into the pinion 51 starts to move in a left direction (illustrated by dotted arrows in FIG. 5).  
18 Accordingly, the first lever 40a pivots in a clockwise direction and the second lever 40a pivots in  
19 a counterclockwise direction. Due to the pivotal movements of the first and the second levers 40a  
20 and 40b, the first and the second holders 20a and 20b return to be received in the case 100 as shown  
21 in FIG. 2. At this point, the torsion springs 22a and 22b stretch. Accordingly, the torsion springs

1 22a and 22b prevents the protrusions 41a and 41b of the first and the second levers 40a and 40b from  
2 radically moving along the guide slots 21a and 21b, so that the first and the second holders 20a and  
3 20b move along a nearly linear track and are received in the case 100. Then, the paper "P" being  
4 supported by the first and the second holders 20a and 20b drops onto the tray 10 to be stacked.

5 [0039] If the motor 50 further drives the pinion 51 in the state of FIG. 5 in the normal  
6 direction, the rack 30 further moves in the right direction. The further movement of the rack 30, as  
7 shown in FIG. 6, makes the first lever 40a further pivot in the counterclockwise direction to be  
8 positioned near to the second lever 40b. Since the driven gear 43b of the second lever 40b is  
9 positioned at an ending point of the second gear teeth 31b of the rack 30 as shown in FIG. 5, the  
10 second lever 40b does not pivot any further although the rack 30 moves further. Thus, a distance  
11 between the first and the second holders 20a and 20b becomes narrow, thereby supporting the paper  
12 "P" having a narrow width.

13 [0040] Although this embodiment uses the motor 51 as a driving source for moving the rack  
14 30, it is possible that the rack 30 moves in association with a movement of a carrier (not shown)  
15 which reciprocates in a direction perpendicular to the sheet discharging direction "A" with an ink  
16 cartridge (not shown) mounted thereon.

17 [0041] According to the present invention as described above, the pair of holders 20a and  
18 20b move toward and away from each other by the driving of the motor 50, thereby supporting  
19 various kinds of sheet having different widths and keeping them elevated above the tray 10.

20 [0042] Also, according to the present invention, since the holders 20a and 20b stretch from  
21 a position where the holders 20a and 20b are received in the case 100 to the sheet discharging

1 direction "A" to support the paper "P" as the first and the second levers 40a and 40b pivot, a size of  
2 the printer body can be reduced.

3 [0043] Furthermore, according to the present invention, since the holders 20a and 20b are  
4 received in the case 100 when the printer stands by to print a sheet, damages generated by an external  
5 shock can be prevented.

6 [0044] Although the preferred embodiment of the present invention have been described, it  
7 will be understood by those skilled in the art that the present invention should not be limited to the  
8 described preferred embodiment, but various changes and modifications can be made within the  
9 spirit and scope of the present invention as defined by the appended claims.